

## DIVERSITY, OCCURRENCE AND ABUNDANCE OF ODONATES OF TUNGA RIVER BANK, ADJOINING FIELDS AND CULTIVATED LANDS IN SHIVAMOGGA DISTRICT OF KARNATAKA, INDIA

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### ABSTRACT

**Objective:** The major objective of this study was to find out the diversity, occurrence, and abundance of odonates of Shivamogga at three localities, viz., Tunga river bank, adjoining fields, and cultivated lands.

**Methods:** Odonates were sampled for 5 months from July to November 2016. Field observations were made once in a week. They were observed, captured, identified, and released immediately at the spot of capture. Odonates were identified using field guides and handbook of common odonates of central India.

**Results:** A total of 29 species of odonates belonging to 7 families and 24 genera were recorded from the study localities. 14 species of dragonflies and 15 species of damselflies were observed and identified.

**Conclusion:** The present investigation shows that the study localities host a number of odonates. Due to different anthropogenic activities, the odonates diversity is in declining mode.

**Keywords:** Odonates, Dragonflies, Damselflies, Shivamogga, Karnataka.

### INTRODUCTION

Dragonflies and damselflies collectively called odonates are one of the most common insects flying over forest, fields, meadows, ponds, and rivers [1]. The order *Odonata* is divided into three suborders, *Anisoptera* (dragonflies), *Zygoptera* (damselflies), and *Anisozygoptera*. The suborder *Anisozygoptera* is living fossil, have two species. One of them *Epiophlebia laidlawi* is known from Darjeeling, North Bengal, India [2]. Dragonflies and damselflies can easily be distinguished in the field. Odonates are known as ecological indicators of any freshwater ecosystem because they are very selective and sensitive about their breeding habitat. They also play a key role as prey and predator to maintain the balance of trophic levels of food chain [3]. In the invertebrate world, odonates always attract the human beings for their variety of color, powerful flight and extraordinary sense of vision. The adults are terrestrial and larvae are aquatic. Larvae have been recorded as voracious predators and useful in the control of mosquitoes which pass on diseases to human beings [4].

The life cycle of dragonfly depends on the availability and quality of water. Some species of dragonfly nymph are very sensitive to water pollution because their whole life is spending in the water [5]. The rural areas have higher species richness as compared to urban areas. Worldwide almost 5952 different species of odonates have been recorded of which India contributes with 475 species [6]. Several studies from different parts of India have already documented the diversity and abundance of odonates [7-10]. The study of odonates fauna in Shivamogga has not been comprehensively carried out. In this paper, an attempt is made to study the diversity, occurrence, and abundance of odonates of Tunga river bank, adjoining fields and cultivated lands. Thus, it will provide relevant information about odonates, which could serve as a frame of references for future initiatives in studying odonates diversity.

### METHODS

#### Study area

Shivamogga (13°55' 18" N, 75°34' 12" E) is a heartland of Karnataka state, located on the banks of river Tunga. The study area comprises

6 km from old Tunga bridge to Subbaiah Medical College. Climate of Shivamogga is tropically wet and dry. This means that the winter and the early part of summer are typically dry periods. The majority of the rainfall occurs between June and early October. Shivamogga is part of region vernacularly known as Malnad (Land of hills) in Karnataka. Most of these hills are part of the Western Ghats, a region famous of plentiful rainfall and lush greenery.

#### Sampling

The study was conducted bimonthly for 5 months from July to November 2016 in three different habitats across the study area. Sampling of adult odonates were carried out during morning and evening in all habitats. A collection of specimens was done with the help of specially design insect net.

#### Odonates counting

Counting of a number of each dragonfly and damselfly species is done directly in their habitat. Calculations performed three times for each location. The data then averaged for each location.

#### Determination of abundance

The species were further divided into four categories: Very common (VC), Common (C), not rare (NR), and rare (R) on the basis of their count from the study area. Any species with count less than 4 times were placed in rare category, count between 5 and 9 were placed in NR category, count between 10 and 14 were categorized as C while species with count more than 15 times were placed in VC category.

#### Identifications of odonates

Odonates were observed, captured, identified and released immediately at the spot of capture. The odonates which were difficult to identify in the field were collected as voucher specimens using a hand net. The dead specimens were kept in insect collection box. Identification was done by observing wing venation, color pattern, and genitalia described in standard taxonomic literature and field guides [11-13]. Secondary data were obtained from published literature [9,14].

## RESULTS AND DISCUSSION

Results of odonate diversity are given in Table 1 and depicted in Figs. 1-25. A total of 29 different odonate species belonging to 7 families and 24 genera were found in Tunga river bank, adjoining fields, and cultivated lands. Species composition of different families is depicted in Graph 1. No previous study was found on odonate diversity of the

Tunga river bank, adjoining fields, and cultivated lands, and thus it was not possible to compare the findings with previous one.

## Dragonflies

Out of the 29 odonates, dragonflies represented with 14 species. 13 species of dragonflies sighted in the family *Libellulidae*, while *Aeshnidae* was represented by a single species.

Table 1: Occurrence and abundance of odonates of Tunga river bank, adjoining fields and cultivated lands of Shivamogga

| Sl.No.                         | Scientific names                                  | Common names              | Occurrence |   |    |   | Abundance |        |           |         |          |
|--------------------------------|---|---------------------------|------------|---|----|---|-----------|--------|-----------|---------|----------|
|                                |   |                           | VC         | C | NR | R | July      | August | September | October | November |
| Dragonflies                    |   |                           |            |   |    |   |           |        |           |         |          |
| Family: <i>Libellulidae</i>    |   |                           |            |   |    |   |           |        |           |         |          |
| 01                             | <i>Acisoma panorpoides</i> Rambur, 1842           | Trumpet tail              | -          | - | ✓  | - | -         | 1      | 3         | 3       | 2        |
| 02                             | <i>Brachythemis contaminata</i> Fabricius, 1793   | Ditch jewel               | ✓          | - | -  | - | 2         | 6      | 4         | 4       | 1        |
| 03                             | <i>Bradinyopyga geminata</i> Rambur, 1842         | Granite ghost             | -          | ✓ | -  | - | 4         | 2      | 5         | 2       | 1        |
| 04                             | <i>Diplocodes trivialis</i> Rambur, 1842          | Ground skimmer            | -          | ✓ | -  | - | -         | 3      | 3         | 4       | 1        |
| 05                             | <i>Hydrobasilieus croceus</i> Brauer, 1867        | Amber-winged glider       | -          | - | -  | ✓ | 1         | 1      | 1         | 1       | -        |
| 06                             | <i>Neurothemis tullia</i> Drury, 1773             | Pied paddy skimmer        | -          | ✓ | -  | - | 4         | 3      | 2         | 4       | 1        |
| 07                             | <i>Orthetrum pruinosum</i> Burmeister, 1839       | Crimson tailed hawk       | ✓          | - | -  | - | 2         | 4      | 4         | 5       | 1        |
| 08                             | <i>Orthetrum sabina</i> Fabricius, 1793           | Green marsh hawk          | -          | ✓ | -  | - | 1         | 4      | 2         | 3       | 1        |
| 09                             | <i>Pantala flavescens</i> Fabricius, 1793         | Wandering glider          | ✓          | - | -  | - | 2         | 6      | 5         | 3       | -        |
| 10                             | <i>Potamarcha congener</i> Rambur, 1842           | Yellow-tailed skimmer     | ✓          | - | -  | - | 2         | 3      | 4         | 6       | 2        |
| 11                             | <i>Rhyothemis variegata</i> Linnaeus, 1763        | C picture wing            | -          | ✓ | -  | - | 5         | 1      | 3         | 2       | -        |
| 12                             | <i>Tholymis tillarga</i> Fabricius, 1798          | Coral-tailed cloud wing   | ✓          | - | -  | - | 3         | 3      | 5         | 2       | 2        |
| 13                             | <i>Trithemis aurora</i> Burmeister, 1839          | Crimson marsh glider      | -          | ✓ | -  | - | 1         | 3      | 4         | 1       | 2        |
| Family: <i>Aeshnidae</i>       |   |                           |            |   |    |   |           |        |           |         |          |
| 14                             | <i>Gynacantha dravida</i> Lieftinck, 1960         | Brown darner              | -          | ✓ | -  | - | 3         | 1      | 2         | 2       | 2        |
| Damsel flies                   |   |                           |            |   |    |   |           |        |           |         |          |
| Family: <i>Coenagrionidae</i>  |   |                           |            |   |    |   |           |        |           |         |          |
| 15                             | <i>Aciagrion occidentale</i> Laidlaw, 1919        | Green-striped slender     | -          | - | ✓  | - | 3         | 1      | 2         | 1       | -        |
| 16                             | <i>Agriocnemis pygmaea</i> Rambur, 1842           | Pygmy dartlet             | -          | - | ✓  | - | 1         | 2      | 1         | 1       | 2        |
| 17                             | <i>Agriocnemis splendissima</i> Selys, 1877       | Splendid dartlet          | -          | - | ✓  | - | 2         | -      | 2         | 2       | 1        |
| 18                             | <i>Ceriagrion olivaceum</i> Selys, 1877           | Rusty marsh dart          | -          | ✓ | -  | - | 2         | 1      | 5         | 3       | 2        |
| 19                             | <i>Ceriagrion coromandelianum</i> Fabricius, 1793 | Coromandel marsh dart     | -          | ✓ | -  | - | 3         | 2      | 4         | 4       | 1        |
| 20                             | <i>Ischnura senegalensis</i> Rambur, 1842         | Senegal golden dartlet    | ✓          | - | -  | - | 1         | 5      | 2         | 6       | 2        |
| 21                             | <i>Ischnura aurora</i> Brauer, 1865               | Golden dartlet            | ✓          | - | -  | - | 4         | 5      | 5         | 2       | 2        |
| 22                             | <i>Pseudagrion microcephalum</i> Rambur, 1842     | Blue grass dart           | -          | - | ✓  | - | 2         | 1      | 4         | 1       | 1        |
| 23                             | <i>Pseudagrion rubriceps</i> Selys, 1876          | Saffron-faced grass dart  | -          | ✓ | -  | - | 3         | 2      | 4         | 1       | 3        |
| Family: <i>Chlorocyphidae</i>  |   |                           |            |   |    |   |           |        |           |         |          |
| 24                             | <i>Helioacypa bisignata</i> Hagen 1853            | Stream glory              | ✓          | - | -  | - | 3         | 3      | 6         | 3       | 2        |
| 25                             | <i>Libellago lineata</i> Burmeister, 1839         | River heliodor            | -          | ✓ | -  | - | 1         | 2      | 5         | 4       | 2        |
| 26                             | <i>Rhinocypha bisignata</i> Hagen, 1853           | Stream ruby               | -          | ✓ | -  | - | 2         | 4      | 4         | 1       | 1        |
| Family: <i>Platycnemididae</i> |   |                           |            |   |    |   |           |        |           |         |          |
| 27                             | <i>Copera marginipes</i> Rambur, 1842             | Yellow bush dart          | -          | - | ✓  | - | 1         | 3      | 2         | 1       | 2        |
| Family: <i>Lestidae</i>        |   |                           |            |   |    |   |           |        |           |         |          |
| 28                             | <i>Lestes elatus</i> Hagen & Selys, 1862          | Emerald spread wing       | ✓          | - | -  | - | 3         | 5      | 3         | 5       | 3        |
| Family: <i>Calopterygidae</i>  |   |                           |            |   |    |   |           |        |           |         |          |
| 29                             | <i>Vestalis gracilis</i> Rambur, 1842             | Clear-winged forest glory | -          | ✓ | -  | - | 4         | 3      | 1         | 3       | 1        |

VC: Very common, C: Common, NR: Not rare, R: Rare

Fig. 1: *Acisoma panorpoides*Fig. 4: *Diplocodes trivialis*Fig. 2: *Brachythemis contaminata*Fig. 5: *Gynacantha dravida*Fig. 3: *Bradinopyga geminata*Fig. 6: *Hydrobasilieus croceus*

#### Diversity of dragonflies

Dragonflies were represented by only two families. The most diverse group of family was *Libellulidae* represented by 13 species and 12 genera. Genus *Orthetrum* represented by two species, while *Acisoma*, *Brachythemis*, *Bradinopyga*, *Diplocodes*, *Hydrobasilieus*, *Neurothemis*, *Pantala*, *Potamarcha*, *Rhyothemis*, *Tholymis*, and *Trithemis* were represented by a single species each. Family *Aeshnidae* was represented by a single genus (*Gynacantha*). Various researchers from different parts of India have already reported that *Libellulidae* as the most dominant dragonfly family, and this findings corroborate well with those findings [5,7,9].

#### Occurrence of dragonflies

It was found that five species of dragonflies were very common, seven species are common, one species is not rare, and one

species of dragonfly is rare in occurrence in the study areas. Very common dragonflies include *Brachythemis contaminata*, *Orthetrum pruinosum*, *Pantala flavescens*, *Potamarcha congener*, and *Tholymis tillarga*. Common dragonflies include: *Bradinopyga geminata*, *Diplocodes trivialis*, *Neurothemis tullia*, *Orthetrum sabina*, *Rhyothemis variegata*, *Trithemis aurora*, and *Gynacantha dravida*. Rare dragonfly includes *Hydrobasilieus croceus*. These findings are in confirmation with *Odonata* fauna of Coimbatore and Salem districts of Tamil Nadu [14].

#### Abundance of dragonflies

Counting of a number of each odonate species is done directly in their habitat. It was found that amongst the dragonfly species, *B. contaminata* and *P. congener* has the highest density followed by *O. pruinosum*, and *P. flavescens*, whereas the *D. trivialis*, *O. sabina*, *R. variegata*, and *T. aurora* are found to have the least population density. The highest



Fig. 7: *Neurothemis tullia*



Fig. 11: *Pantala flavescens*



Fig. 8: *Orthetrum pruinatum*



Fig. 12: *Rhyothemis variegata*



Fig. 9: *Orthetrum sabina*



Fig. 13: *Tholymis tillarga*



Fig. 10: *Potamarcha congener*



Fig. 14: *Trithemis aurora*

**Damselflies**

Out of the 29 odonates, damselflies represented with 15 species. Nine species of damselflies sighted in the family *Coenagrionidae*. *Chlorocyphidae* was represented by three species, while *Platycnemididae*, *Lestidae*, and *Calopterygidae* were represented by a single species each. So far, as the damselflies were concerned

density of dragonflies was recorded in the month of September, and lowest density was recorded in the month of November.

Fig. 15: *Aciagrion occidentale*Fig. 18: *Coper marginipes*Fig. 16: *Agriocnemis splendissima*Fig. 19: *Ceriagrion olivaceum*Fig. 17: *Ceriagrion coromandelianum*Fig. 20: *Helioacypha bisignata*

*Coenagrionidae* was recorded as the most dominant family in this study. These findings are in conformation with other researchers [15,16].

#### Diversity of damselflies

Damselflies were represented by five families. The most diverse group of family was *Coenagrionidae* represented by nine species and five genera. Genera *Agriocnemis*, *Ceriagrion*, *Ischnura*, and *Pseudagrion* were represented by two species each, while *Aciagrion* was represented by a single species. Family *Chlorocyphidae* was represented by three species. Genera *Helioacypha*, *Libellago*, and *Rhinocypha* were represented by a single species each. Families *Platycnemididae*, *Lestidae*, and *Calopterygidae* were represented by a single species.

#### Occurrence of damselflies

It was found that four species of damselflies were very common, six species are common and five species are not rare in occurrence in the study areas. Very common damselflies include *Ischnura senegalensis*, *Ischnura aurora*, *Helioacypha bisignata*, and *Lestes elatus*. Common species include *Ceriagrion olivaceum*, *Ceriagrion coromandelianum*, *Pseudagrion rubriceps*, *Libellago lineata*, *Rhinocypha bisignata*, and *Vestalis gracilis*. Not rare damselflies include *Aciagrion occidentale*, *Agriocnemis pygmaea*, *Agriocnemis splendissima*, *Pseudagrion microcephalum*, and *Coper marginipes*.

#### Abundance of damselflies

It was found that among the damselfly species, *L. elatus*, *I. aurora* has the highest density followed by *H. bisignata*, and *I. senegalensis*, whereas



Fig. 21: *Lestes elatus*



Fig. 24: *Vestalis gracilis*



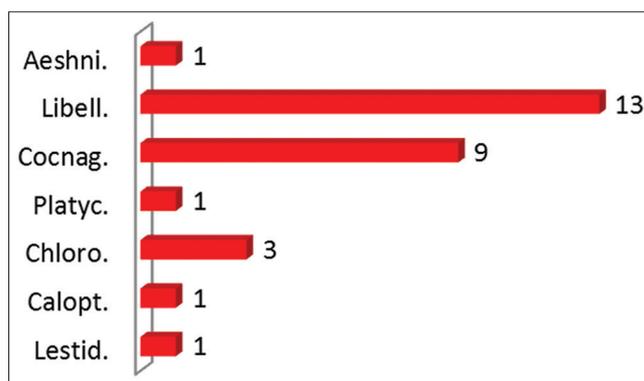
Fig. 22: *Libellago lineata*



Fig. 25: *Pseudagrion microcephalum*



Fig. 23: *Rhinocypha bisignata*



Graph 1: Species composition of different families

the *A. occidentale*, *A. pygmaea*, and *A. splendissima* are found to have the least population density. The highest density of dragonflies was recorded in the month of September, and lowest density was recorded in the month of November.

**CONCLUSION**

This study was the first attempt to make a checklist of odonates and look for their occurrence and abundance pattern from Tunga river bank, adjoining fields, and cultivated lands and further investigations are needed to portray a comprehensive picture of odonates from these

areas. Findings made during this study indicated that odonate diversity of these areas constitute a valuable natural resource in ecological and scientific terms and its conservation and management are critical to the interests of humankind itself. However, these regions might witness a rapid decrease in *Odonata* diversity in coming years due to deteriorating habitat conditions and immense anthropogenic pressure. Therefore, appropriate conservation measures are required to protect and conserve the *Odonata* populations from Tunga river bank, adjoining fields, and cultivated lands.

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